APPENDIX M

1. Input the preprocessed design matrix X of dimension $M \times K$
2. Input the observed outcome vector Y of dimension $M \times 1$
3. Compute the SVD of X, *i.e.*, $X = USV^T$, where $U = (U_1, U_2, \ldots, U_k)$, $V = (V_1, V_2, \ldots, V_k)$ are left and right singular vectors, respectively
4. Compute the solution vector of the model as

$$\beta = \sum_{i=1}^{K} \left(\frac{U_i Y}{\sigma_i} \right) V_i$$

where σ_i are the singular values, and $U_i Y$ are the vector dot product between U_i and Y. In one embodiment, in order to avoid some potential overflow that may occur in this step due to possible small singular values, a threshold (e.g., 10e-5* max(singular values) to eliminate small values is implemented.

A corresponding prototype code is listed below:

```
load X.dat;
load y.dat;
y = y';
[m, n] = size(X);
[U,S,V] = svd(X,0);
sigma = 10E-5 * S(1,1);
k = 0;
for i = 1:n
        if (S(i,i) >= sigma)
                k = k + 1;
        end
end
beta = 0;
for i = 1:k,
        beta = beta + ((U(:,i)'*y)/S(i,i))*V(:,i);
end
beta
```